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# INTERMEDIATE PRESSURE AIR SYSTEM

DESCRIPTION AND OPERATING  
INSTRUCTIONS

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## 1. DESCRIPTION

## A. PURPOSE AND BASIC SPECIFICATIONS

The shipboard intermediate pressure air system is used to supply air:

- (1) to the torpedo tubes;
- (2) for trimming the submarine;
- (3) for blowing the depth finder;
- (4) to pneumatic tools;
- (5) to the pneumatic mechanism closing the conning tower hatch;
- (6) for locking the conning tower;
- (7) for releasing the towing hook;
- (8) to the typhoon and syren;
- (9) for mechanical agitation of the electrolyte in the storage batteries;
- (10) to the pneumatic clutches;
- (11) for blowing the garbage disposal unit;
- (12) for blowing the bath and vents and the sea valves;
- (13) for blowing the WC sanitary bottles;
- (14) to the mechanism of the torpedo-loading gear (feeding is effected through the pneumatic tools of Nos I and III compartments);
- (15) for draining No.3 fuel tank;
- ~~(16) to the gas analyzer;~~
- (17) for transferring water from No.2 compensating tank of one side to the other and for draining Nos 1 and 2 compensating tanks overhead;
- (18) for transferring battery water;
- (19) for transferring the distillate from the distilling plant tank to the fresh or distilled water tanks;
- (20) for transferring fresh water and for draining the fresh water tanks;
- (21) to the automatic shut-off valves of the torpedo tubes;
- (22) for draining the fuel tanks outside the pressure hull, *and the conning tower fuel tank No.2*
- (23) for draining the torpedo tubes, access trunk, and for draining the conning tower;
- (24) to the air system (PTU-52);
- (25) to the pneumatic mechanism of the exhaust mechanism valve of the propeller.

The shipboard intermediate pressure air system is made of red copper, galvanized steel, and steel. The pipes are connected through unions and flanges. The valves and fittings are made of bronze, the rest of the system is made of steel.

The shipboard air system is tested under air pressure. The test is carried out on the test of the separate sections and the whole system.

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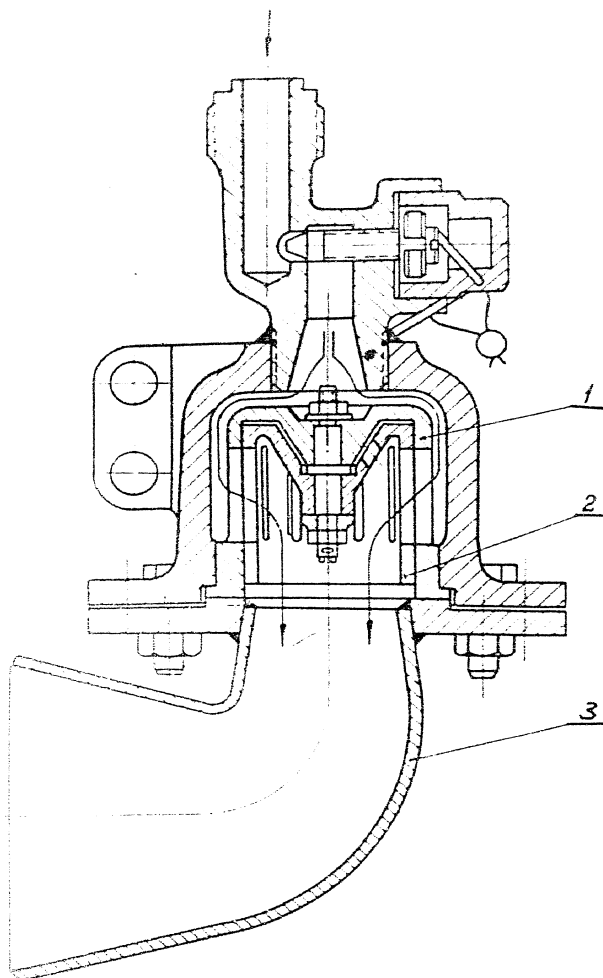


Fig. 1. Air Syren  
1—stator; 2—rotor; 3—trumpet

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## B. GENERAL DESCRIPTION AND THE FUNCTION OF INDIVIDUAL UNITS

The intermediate pressure air system includes the pipe line with branches running to the consumers, six-valve manifold, shut-off fittings, interlock valve, automatic reduction manifold and the valves, pressure gauges, safety valves, strainers.

The intermediate pressure air pipe line runs along the pipe deck all the whole length of the submarine.

In the ship's control centre the intermediate pressure air pipe line is subdivided with valves Nos 14 and 24 into three sections: forward, after and that of the control centre. Air from the mains flows to the consumers.

Laid in the control centre besides the principal mains is the blow line of compensating tanks Nos 1 and 2.

The blow line of No.2 compensating tank has six-valve manifold 56. Air to the manifold is fed from the high-pressure air system.

Manifold 50 has five shut-off valves. Valve 48 is used as the common shut-off valve and throttle valve. This valve reduces pressure down to 15 kgf./sq. cm. which is checked by pressure gauge 45, excessive pressure being relieved by safety valve 49 adjusted to pop at a pressure of 25 kgf./sq. cm.

Valves 47 and 52 are not in use and therefore, they are plugged.

Shut-off valves 46 and 51 are directly connected to the vent pipes of No.3 upper compensating tank, starboard and port.

Shut-off valve 53 is used for blowing the manifold.

### Air Siren (Fig.1)

This is meant for sending sound signals. The air passes the window in the manifold into the vertical edges of rotor 2 and thus rotating the rotor enters the atmosphere through trumpet 3. When rotor 2 rotates, the air pressure in the trumpet is intensified in the trumpet.

The air pressure is high.

### Air Horn (Fig.2)

This is used for sending sound signals. The air enters casing 4, flows into the chamber 5 and reflects the latter and escapes into the atmosphere. The pressure in the chamber is created by the pulsating air from the manifold, thus producing sound intensified in the chamber.

The air pressure in the chamber changes the pressure of cover 1 and ring 2 upon

the air pressure in the chamber.

The air pressure in the chamber.

The air pressure in the chamber is fed to the syren and to the typhoon. When lever 1 is pressed, the air pressure is pressed off seat 3 of the body. Air from the syren is fed to the typhoon, wherefrom it is fed to the syren and to the typhoon.

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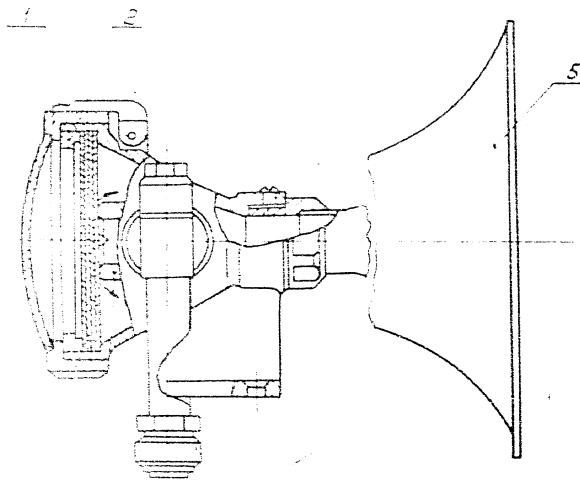


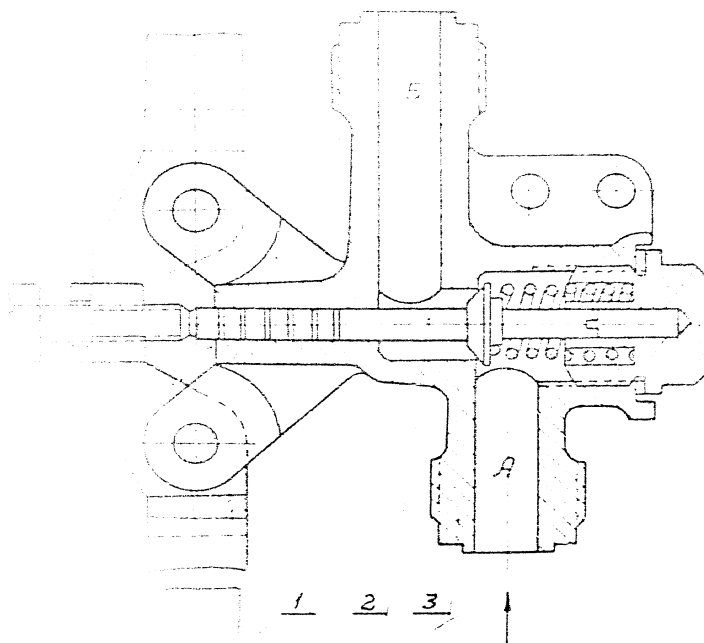
FIG. 1. A. Top View  
B. Side View  
C. Front View  
D. Back View  
E. Detail of Horn

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Starting Valve  
Submergible seat

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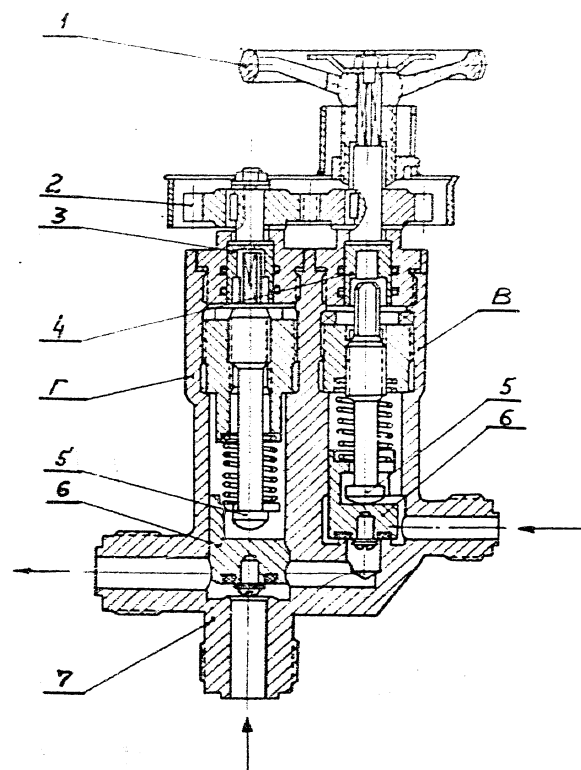


Fig. 4. Interlock Valve

1-handwheel; 2-gears; 3-shaft;  
4-shaft; 5-spindle; 6-plate;  
7-body

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Interlock Valve (Fig. 4)

This is used for supplying air from the intermediate pressure air line to the machine of the torpedo loading gear, typhoon and to the syren.

When the valve is in the OPERATION position, the air is fed to the typhoon and to the syren.

When the valve is in the BLOWING (REPAIRING) position, the air from the pneumatic tool through the hose enters the machine of the torpedo-loading gear, while the intermediate pressure air line gets cut out.

The interlock valve consists of bronze body 7 and two cocks B and T, each being provided with its own disc 6 and spindle 5. Fitted on square ends of both spindles 5 are shafts 3 and 4 which have square sockets. The shafts are interconnected through gears 2. One of the shafts has handwheel 1. When cock B is closed, the other cock T is open. When rotating handwheel 1 for opening, i.e. when shifting to the BLOWING position, cock B remains closed due to free travel of the spindle and at the same time cock T which cuts out the intermediate pressure air line, starts closing. After cock T gets completely closed, cock B to which the hose running from the pneumatic tool is connected starts opening. When rotating the handwheel for closing, i.e. when shifting to the OPERATION position, after cock B is closed, cock T starts opening. The cock T connects the intermediate pressure air line with the typhoon and the syren.

Six-Valve Manifold

(See the Appendix, Ref. No.50)

This is intended for blowing No.2 compensating tank and consists of a body with four shut-off valves welded to it.

From one side of the manifold body a pressure-reducing valve with a handle and a socket for a pressure gauge is screwed and packed with a gasket. Screwed from the other side of the manifold body is the hose, packed with a paronite gasket.

Ref. No. 250/5-35M-3  
(Appendix, Ref. No.16)

This is used for reducing pressure of the compressed air from 35 kgf/sq.cm to 5 kgf/sq.cm and lower.

If the pressure is not reduced, may be due to throttling of air, the reducer is not working properly. Check the reducer when in use.

For more detailed description of the reducer see the respective Instructions.

Ref. No. 250/35 kgf/sq.cm

(Appendix, Ref. No. 17)

This is used for reducing pressure of the compressed air and differs from the previous one in the plate shape only.

It is not fast enough to adjust pressure ranging from 0 to 35 kgf/sq.cm.

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No.	Description	Model	Maximum working pressure, red line kgf/sq.cm	Installation of indicator	Remarks
10	Pressure gauge to measure air pressure in intermediate pressure air line on hand-operated throttle valve 17	MTK 100Bx 40/35	35/35	Compartment III	
2	Pressure gauge to measure pressure of air fed to pneumatic tool on cross-connection 3	MTK 100Bx 10/6	6/6	Compartments I, III, VII	
43	Pressure gauge to measure pressure of air fed for blowing No.1 compensating tank	MTK 100Bx 6/3	3/3	Compartment III	
45	Pressure gauge to measure pressure of air fed for blowing No.2 compensating tank	MTK 100Bx 40/25	25/25	Compartment III	
33	Pressure gauge to measure pressure of air fed to garbage disposal unit	MTK 100Bx 60/35	35/35	Compartment IV	
27	Pressure gauge to measure pressure of air fed for drying fuel tanks	MTK 100Bx 4/2	2/2	Compartment V	
9	Pressure gauge to measure pressure of air fed for electrolyte agitation	MTK 100Bx 0.6/0.2	0.2/0.2	Compartments II, IV	Green line, 0.15 kgf/sq.cm

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## II. OPERATING INSTRUCTIONS

## A. GENERAL SUPERVISORY INSTRUCTIONS

1. Keep the pipe lines, joints and fittings in good condition and eliminate troubles, if any.

See to it that the seals of the pressure gauges and the safety valves are intact.

Prior to navigation:

2. Check the Certificates which confirm serviceability of the pressure gauges for the current year and adjustment of the automatic reducer.

## B. PREPARING SYSTEM FOR ACTION

3. In the initial position, when in base or at sea, the intermediate pressure air system is kept under pressure, supply from the high-pressure air system being performed through automatic reducer 16.

Valves 14, 15, 24 and the high-pressure air valve for the reducer are open, the rest of the valves being closed.

Valve 37 is in the OPERATION - (PASOIA) position.

Notes: 1. When in base the system is kept under pressure to ensure air supply to the fire mains (REF-52).

2. When submerging, close outboard valve 38 and open it when surfacing.

## C. STARTING, DURING-SERVICE MAINTENANCE AND STOPPING

4. To send signals either by the typhoon or by the syren, open the starting valve 39.

5. For feeding air to the pneumatic tool, first open the pneumatic tool valve and then throttle valves 1, depending on the place of operation. Order not to break the hose.

When using these valves see that pressure does not exceed that indicated off pressure gauge 2.

Prior to disconnecting the pneumatic tool, close throttle valve 1 and pull off the hose. Disconnect the hoses and screw on the plug nuts.

6. To feed air to the machine of the torpedo-loading gear, set automatic reducer 16 in the BLOWING position. Remove plugs from hose connections and connect the latter through the pneumatic tool hose. Open valve 24.

Feeding is performed in accordance with the directions outlined under "Feeding" according to the Operating Instructions for the torpedo-loading gear.

7. To start the electrolytic mechanical agitation system of the storage compartments of Nos II and IV compartments open throttle valve 3 and close valve 5.

8. To stop the electrolytic mechanical agitation system of the storage compartments of Nos II and IV compartments open throttle valve 5 and close valve 3.

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When feeding air to the conning tower, the conning tower fuel tanks, or wells, check the pressure of the air supply. See to it that the pressure does not exceed 1.5 kgf/sq.cm. If the pressure is exceeded by the throttle valve, the pressure is reduced to the required level.

Reducer 16 of the electric air supply system is closed and pressure from 0.5 kgf/sq.cm is maintained.

4. To release the conning tower fuel tanks from the pressure, close valve 4. Are closed and open valves 22 and 42.

On completion of the work, the pressure is released.

5. To release the fuel tanks, open valve 14.

**CAUTION:** Prior to commencing the work, the pressure in the conning tower fuel tanks and board valves 1, 42 and 14 are closed.

10. To feed air for blowing fuel compensating tanks, open valve 21, checking the air pressure by pressure gauge 43. See to it that the pressure does not exceed 1 kgf/sq.cm.

11. To feed air for blowing No.2 upper compartment (No.2 fuel tank, No.2 starboard), open valves 46, 51 and 48 on manifold.

**Note:** 1. When opening throttle valve 4, check the air pressure by pressure gauge 45. See to it that the pressure does not exceed 25 kgf/sq.cm.

2. Blow No.2 compensating tank from both sides simultaneously.

12. To drain No.3 fuel tank, first open valve 28 in compartment III and then slowly open throttle valve 25 in compartment V.

When manipulating this valve, carefully watch the pressure on the pressure gauge 27. See to it that the pressure does not rise above 2 kgf/sq.cm.

13. Prior to ventilating the conning tower inside the pressure hull, see to it that valves 22 and 42 are closed and then open valves 23 and 43.

14. To feed air to the trimming pipe line, open valve 26.

15. To supply air to the garbage disposal unit hopper, open valve 47.

16. To feed air for blowing the fuel tanks outside the pressure hull, connect the hose to cross-connection 3 in compartment III or VII depending on the tanks location. Slowly open throttle valve 1 and carefully watch the pressure of air by the pressure gauge. See to it that the pressure does not exceed 2.5 kgf/sq.cm.

17. Air supply to the other consumers listed in Section "A" of the Description is effected through the branch pipes of the mains.

18. In case of damage to automatic air reducer 16, close valve 15 and the high-pressure air supply valve and having connected the required consumers, slowly open throttle valve 17 to obtain the required pressure as read off pressure gauge 19.

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- CAUTION!**
1. When manipulating throttle valve 17, constantly keep an eye on pressure gauge 19 to see that the air pressure does not rise above 35 kgf/sq.cm.
  2. In case of protracted operation of reducer 16, do not fail to switch on the electric heater to avoid icing of the reducer.
  3. In case an ambient air temperature drops below  $0^{\circ}\text{C}$ , drain water from the pipe line of the mechanism closing the conning tower hatch outside the pressure hull every time after surfacing, for which purpose open valves 23 and 42. Do this to avoid water freezing.
  4. Everytime after surfacing, drain water from the typhoon and syren pipe lines, for which purpose open valve 40 and then blow the typhoon and the syren.

#### D. MAINTENANCE WHEN NOT IN USE FOR LONG PERIOD

##### Disassembly and Reassembly

19. Prior to disassembly, make sure that the pipe line is not under pressure, otherwise disconnect the pipe line and relieve the pressure.

For disassembly and reassembly of the joints, use two wrenches so that the adjacent joints be left properly tight.

#### E. TROUBLES AND REMEDIES

20. For possible troubles and their remedies see the Table below.

Table 2

No.	Symptom	Condition may be due to	Correction by the ship's force
1	2	3	4
1	Pressure in system rises	Reducer 16 defective	Shift to manipulating hand-operated throttle valve 17
2	Pressure in mains drops	Icing of reducer 16 due to defective electric heater	Shift to manipulating hand-operated throttle valve 17 and eliminate faults in electric heater
3	Pressure in electrolyte agitation system drops	Air filter of system clogged	Clean filter. Replace activated carbon and anti-smoke filter
4	Typhoon does not operate	Diaphragm broken	Replace diaphragm

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1	2	3	4
5	Syren does not operate	Rotor fails to rotate	Clean syren and adjust rotor for free rotation
6	Joints leaky	Joints untight	Replace gasket, tighten up joints

#### F. PREVENTIVE MAINTENANCE AND REPAIRS

##### Daily Inspection

21. Make sure that no air leaks through the joints in the pipe lines, fittings, pressure gauges; check to see that the seals are in place and intact.  
 22. Check all the valves, work out those which are difficult to rotate.

##### Weekly Inspection

Perform the procedures of the daily inspection and besides that:

23. Check operation of the reducer with the heater, syren and the typhoon.

##### Monthly Inspection

Perform the procedures of the weekly inspection and besides that:

24. Replace the gland packings and gaskets of the valves through which air bleeds.  
 Reassemble the valves which are difficult to rotate and cannot be worked out.  
 Check the safety valves for operation.

##### Inspection During Running Repair of Ship

25. Depending on technical condition, disassemble, inspect, reassemble and lap separate outboard and shut-off valves.  
 26. Disassemble, inspect, reassemble and repair the automatic reducer typhoon and the syren.  
 27. Disassemble, inspect, reassemble and adjust the safety valves.  
 28. Every time after repair or disassembly of the system as a whole or its separate sections, perform test for tightness with air fed from the high-pressure system according to Table 3. For the values of test pressure see the diagram presented in the Appendix.  
 Tightness of the system is checked by coating the joints with soap suds.

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1	2	3	4
5	Syren does not operate	Rotor fails to rotate	Clean syren and adjust rotor for free rotation
6	Joints leaky	Joints untight	Replace gasket, tighten up joints

## F. PREVENTIVE MAINTENANCE AND REPAIRS

Daily Inspection

21. Make sure that no air leaks through the joints in the pipe lines, fittings, pressure gauges; check to see that the seals are in place and intact.
22. Check all the valves, work out those which are difficult to rotate.

Weekly Inspection

Perform the procedures of the daily inspection and besides that:

23. Check operation of the reducer with the heater, syren and the typhoon.

Monthly Inspection

Perform the procedures of the weekly inspection and besides that:

24. Replace the gland packings and gaskets of the valves through which air bleeds.
- Reassemble the valves which are difficult to rotate and cannot be worked out.
- Check the safety valves for operation.

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Table 3

No.	Pipe line to be tested	Valve position	Pressure delivery	Remarks
1	Ship's intermediate pressure air mains to shut-off valves leading to consumers	Initial position when underway	From Reducer BJR 250.5-10M-1 in compartment III through valve 15	
2	Pneumatic tool pipe line	Valve 1 open	Through valve 1	
3	Pipe line feeding air to typhoon and syren	Valve 35 closed, valves 37 and 38 open	Through valves 37 and 38	
4	No.1 compensating tank drain line	Valve 21 open	Through valve 21	Through compensating tank
5	No.2 compensating tank drain line	Valves 46, 51 open	Through valves 46, 51	Same

## G. REFERENCE DATA

29. The service life of the rubber-lined hoses is five years, including the term when they are kept at storehouse.

30. List of the drawings for the fittings included into the intermediate pressure air system:

No.	Description	Refs acc. to Dwg	Dwg No.	Remarks
1	Angle shut-off union-connected valve, brass, dia.20, P = 40	7, 12, 14, 15, 20, 22, 23, 24, 41	521-3M30	
2	Angle shut-off valve, steel, dia. 10, P = 100	5, 28, 32	521-01.064	
3	Angle throttle valve, dia. 20, P = 40	10, 21	525-3M2	

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No.	Description	Rate kg/cm <sup>2</sup>	Design No.	Remarks
4	Angle throttle valve, dia. 10, P = 40	1, 25	521-03.001	
5	Angle shut-off valve, with bottom flange, dia. 10	42, 54	521-03.002	
6	Angle shut-off valve with bottom flange, dia. 15	38	521-03.003	
7	Starting valve	39	521-03.004	
8	Shut-off valve, dia. 6, P = 100	40	521-3M516	
9	Safety valve, dia. 10, P <sub>work</sub>	18	524-03.181	Adjusted for P <sub>pop.</sub> = 37 kgf/sq.cm
	(20-65) kgf/sq.cm	49	524-03.180	Adjusted for P <sub>pop.</sub> = 26 kgf/sq.cm
10	Safety valve, dia. 10, P <sub>work</sub> (1-6.5) kgf/sq.cm	4	524-03.173	Adjusted for P <sub>pop.</sub> = 6.2 kgf/sq. Adjusted for P <sub>pop.</sub> = 2.5 kgf/sq.cm
		26		Adjusted for P <sub>pop.</sub> = 3.2 kgf/sq.
		44		
11	Hand-operated pres- sure-reducing valve, dia. 15/20, P = 250 kgf/sq.cm	17	525-1104	Safety valve adjusted for P <sub>pop.</sub> = 37 kgf/sq.cm
12	Reducer, dia. 10/20, in electrolyte agita- tion system	8	590-E21	
13	Filter in electrolyte agitation system	11	427-30.171	
14	Air typhoon	-	565-03.004	
15	Air syren	-	565-03.022	
16	Six-valve manifold, P = 40	50	526-35.001	

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No.	Description	Ref's Acc. to		Design.	Remarks
		Dwg.			
17	Shut-off valve, dia.10, 35, 40 P = 100			521-30-04	
18	Safety valve, dia.10, P <sub>work.</sub> = 0.15 kgf/sq.cm		6	524-3V609	

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*Notes:*

1. The numerators of the fractions at the pipes stand for their designed sizes, while the denominators show the amount of air pressure when testing the assembled pipe line for tightness.
2. Figures at the valves show the popping pressure at which the valve is adjusted.

Hose connection	
Pressure gauge	
Interlock valve	
Safety valve	
Starting valve	
Strainer	
Electrolyte agitation system reducer	
Hand-operated throttle valve	
Automatic reducer	
Intermediate pressure air	
High-pressure air	
Description	Symbol

*Diagram*

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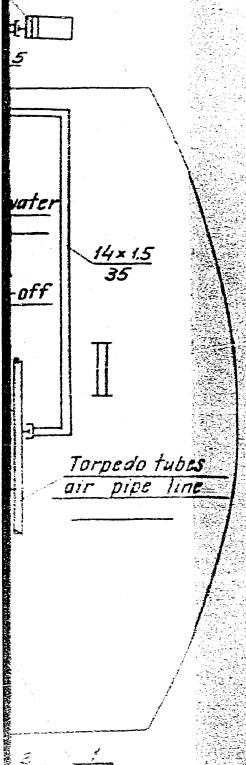
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Appendix I*Notes:*

1. The numerators of the fractions at the pipes stand for their designed sizes, while the denominators show the amount of air pressure when testing the assembled pipe line for tightness.
2. Figures at the valves show the popping pressure at which the valve is adjusted.

Automatic mechanism for  
releasing towing hook

Torpedo Air System Diagram

Hose connection	
Pressure gauge	
Interlock valve	
Safety valve	
Starting valve	
Strainer	
Electrolyte supply system	
Wind operated pneumatic valve	
Automatic valve	

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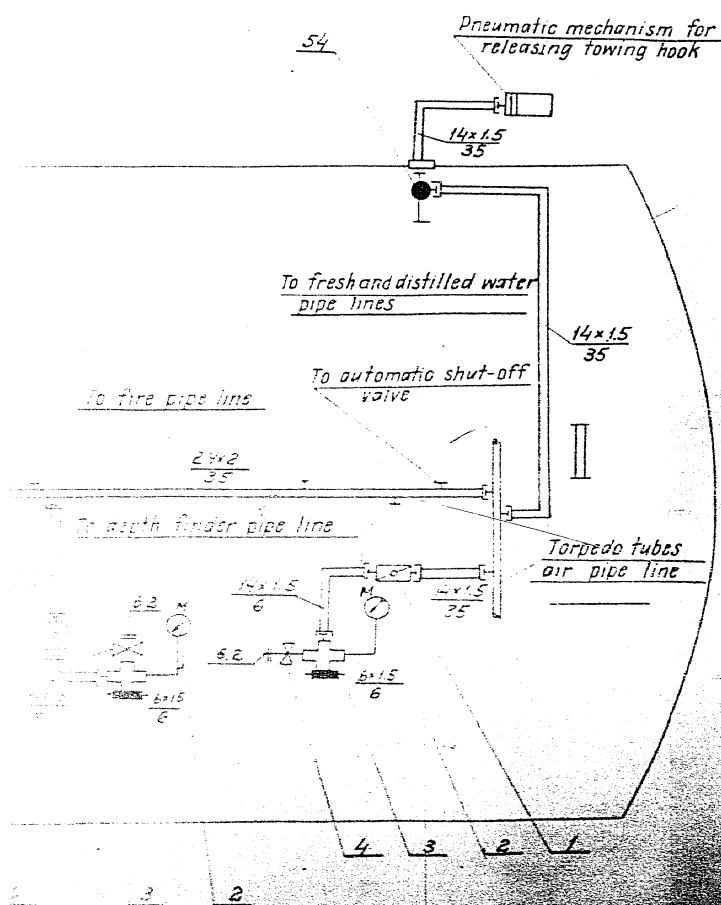


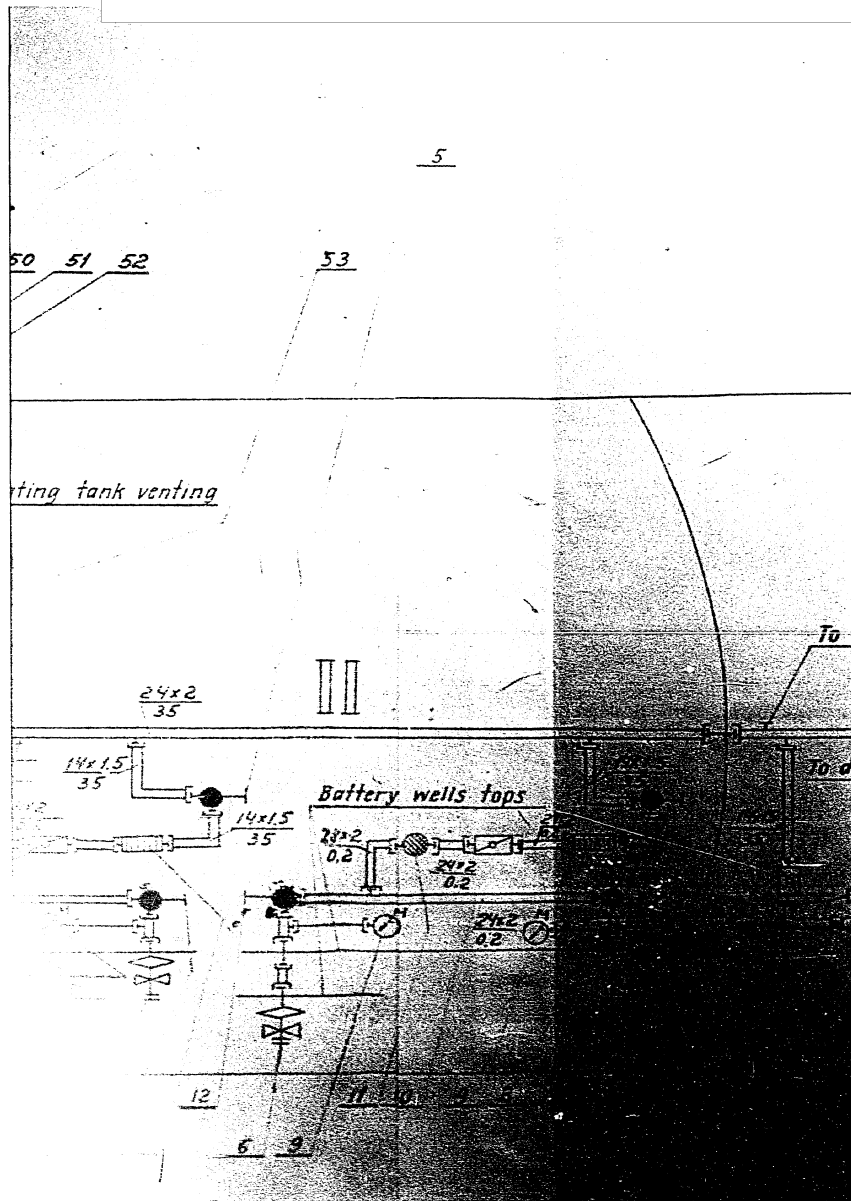
Fig 5 Intermediate Pressure Air System Diagram

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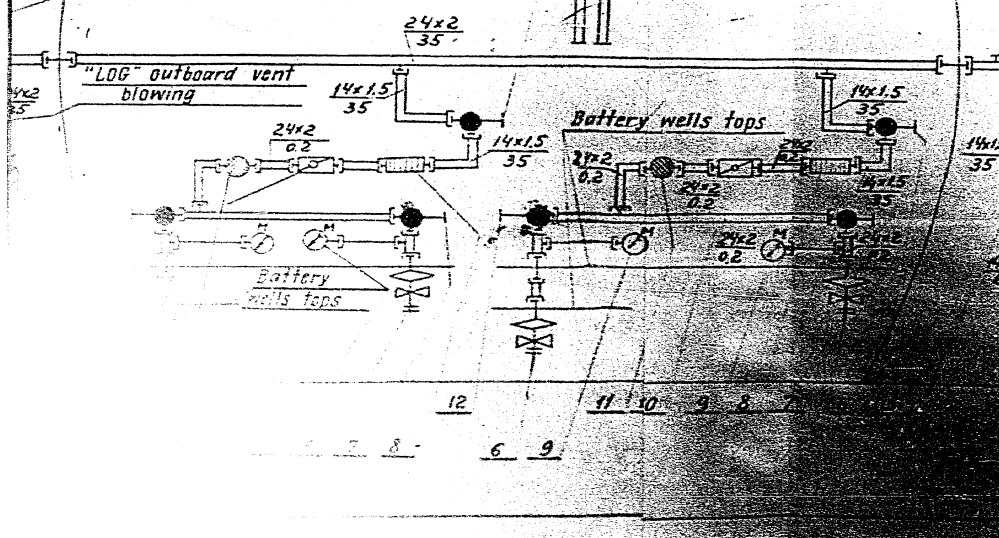
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high-pressure  
mains

No 2 compensating tank venting



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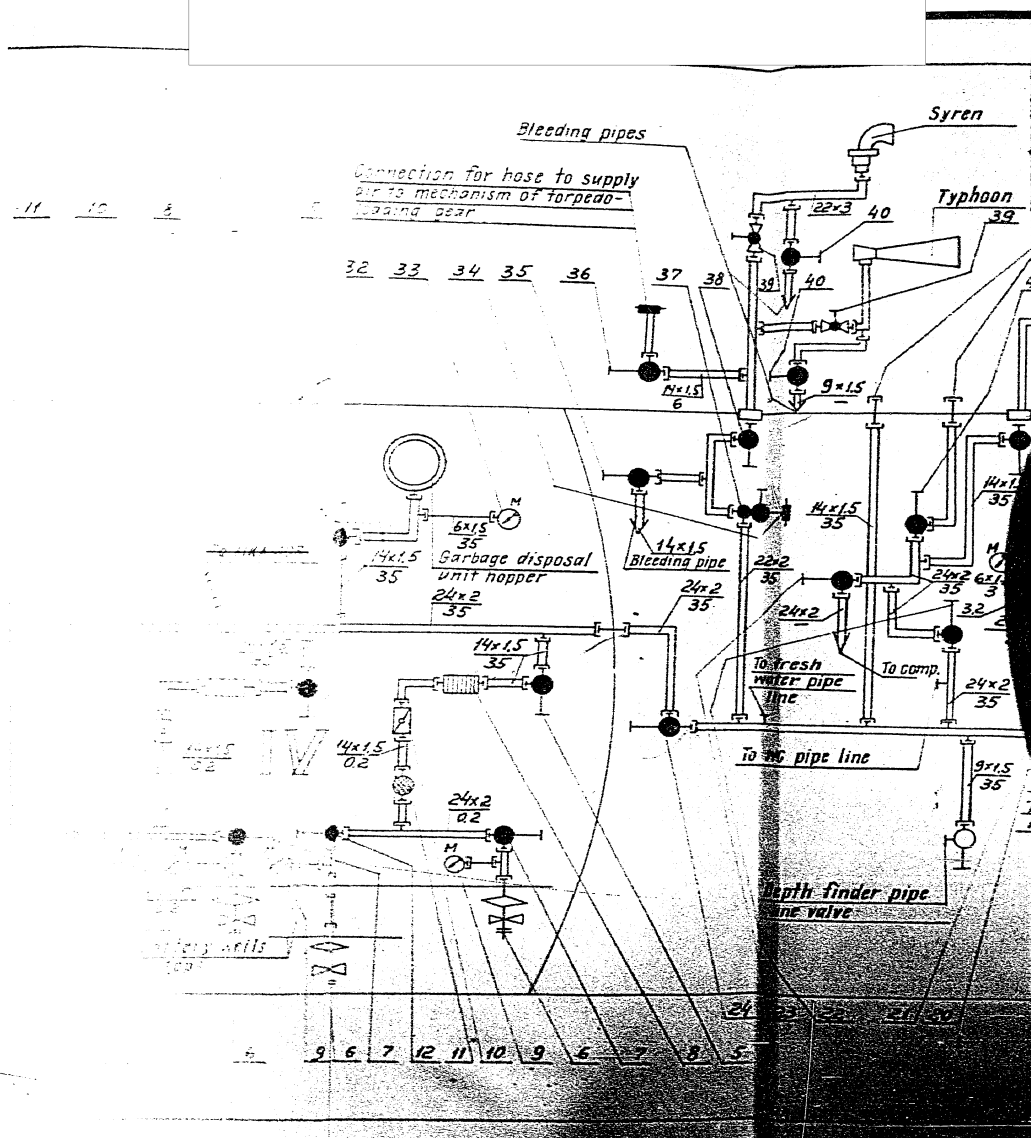




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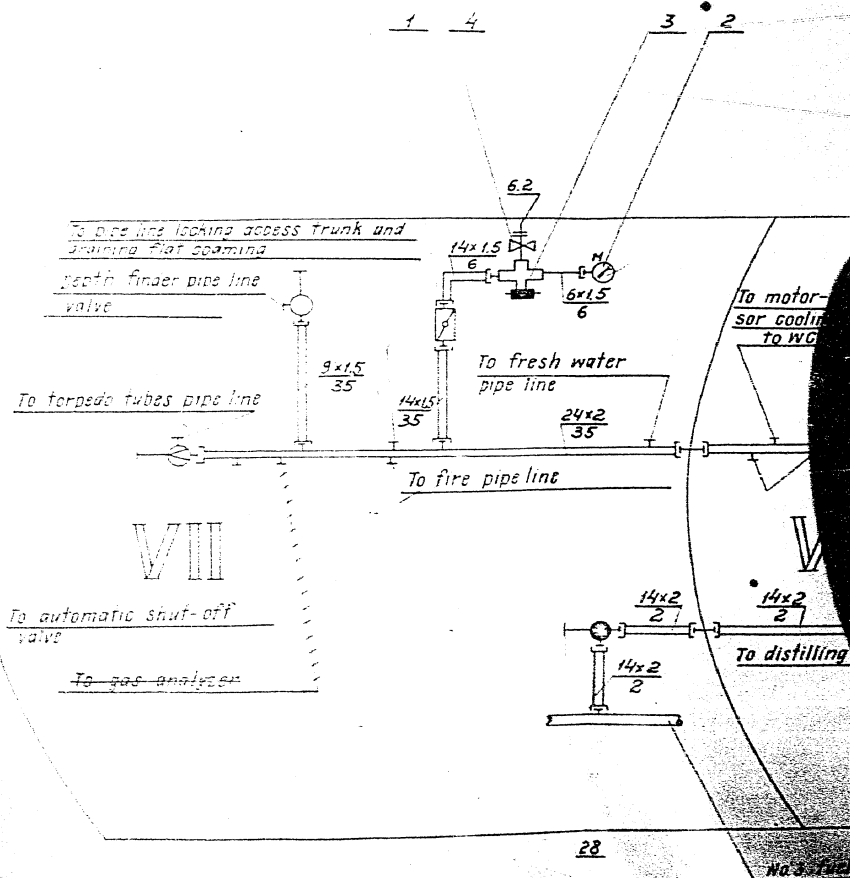
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